SRAM MODULE

128K x 32 SRAM

FEATURES

- High speed: 15*, 20, 25 and 35ns
- High-density 512KB design
- High-performance, low-power, CMOS double-metal process
- Single +5V ±10% power supply
- Easy memory expansion with $\overline{CE}$ and $\overline{OE}$ functions
- All inputs and outputs are TTL-compatible
- Industry standard pinout
- Low profile
- Upgradable to a 256K x 32 module

OPTIONS — MARKING

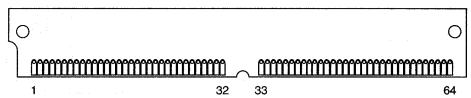
- Timing
  - 15ns access — -15*
  - 20ns access — -20
  - 25ns access — -25
  - 35ns access — -35
- Packages
  - 64-pin SIMM — M
  - 64-pin ZIP — Z
- Optional, 2V data retention — L
- 2V data retention, low power — LP
- Part Number Example: MT4S12832M-15 LP

*Consult factory

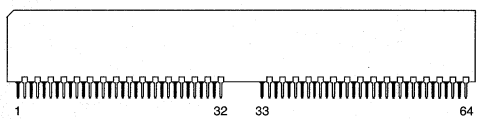
NOTE: Not all combinations of operating temperature, speed, data retention and low power are necessarily available. Please contact the factory for availability of specific part number combinations.

PIN ASSIGNMENT (Top View)

64-Pin SIMM
(SF-3)



64-Pin ZIP
(SG-4)



PIN #	SYMBOL	PIN#	SYMBOL	PIN#	SYMBOL	PIN#	SYMBOL
1	Vss	17	A2	33	$\overline{CE4}$	49	A4
2	PD0	18	A9	34	$\overline{CE3}$	50	A11
3	PD1	19	DQ13	35	NC	51	A5
4	DQ1	20	DQ5	36	A16	52	A12
5	DQ9	21	DQ14	37	$\overline{OE}$	53	Vcc
6	DQ2	22	DQ6	38	Vss	54	A13
7	DQ10	23	DQ15	39	DQ25	55	A6
8	DQ3	24	DQ7	40	DQ17	56	DQ21
9	DQ11	25	DQ16	41	DQ26	57	DQ29
10	DQ4	26	DQ8	42	DQ18	58	DQ22
11	DQ12	27	Vss	43	DQ27	59	DQ30
12	Vcc	28	$\overline{WE}$	44	DQ19	60	DQ23
13	A0	29	A15	45	DQ28	61	DQ31
14	A7	30	A14	46	DQ20	62	DQ24
15	A1	31	$\overline{CE2}$	47	A3	63	DQ32
16	A8	32	$\overline{CE1}$	48	A10	64	Vss

GENERAL DESCRIPTION

The MT4S12832 is a high-speed SRAM memory module containing 131,072 words organized in a x32-bit configuration. The module consists of four 128K x 8 fast SRAMs mounted on a 64-pin, single-sided, FR4-printed circuit board.

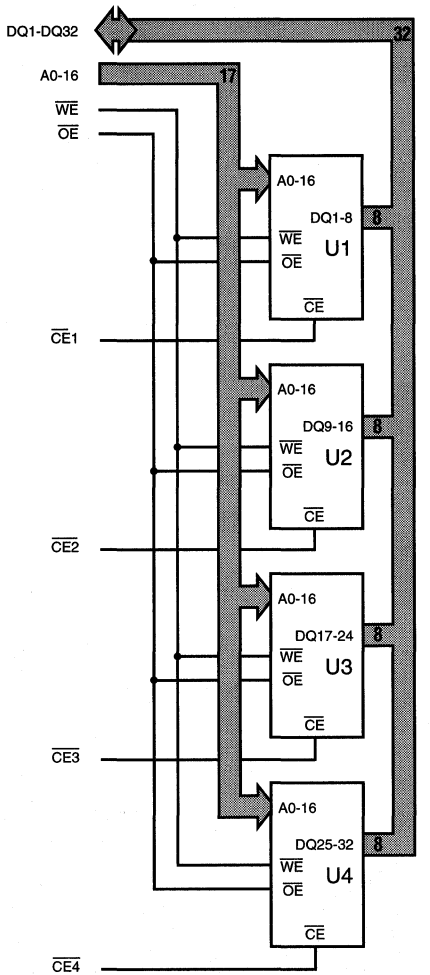
Data is written into the SRAM memory when write enable ($\overline{WE}$) and chip enable ($\overline{CE}$) inputs are both LOW. Reading is accomplished when $\overline{WE}$ remains HIGH and $\overline{CE}$ and output enable ($\overline{OE}$) are LOW. $\overline{CE}$ and/or $\overline{OE}$ can set the output in a High-Z state for additional flexibility in system design and memory expansion.

PD0 and PD1 identify the module's density allowing interchangeable use of alternate density, industry-standard modules. Four chip enable inputs, ($\overline{CE1}$, $\overline{CE2}$, $\overline{CE3}$ and $\overline{CE4}$) are used to enable the module's 4 bytes independently.

The Micron SRAM family uses a high-speed, low- power CMOS design in a four-transistor memory cell featuring double-layer metal, double-layer polysilicon technology. All module components may be powered from a single +5V supply and all inputs and outputs are fully TTL-compatible.

The "L" and "LP" versions each provide a 70 percent reduction in CMOS standby current (I_{SB2}) over the standard version. The "LP" version also provides a 90 percent reduction in TTL standby current (I_{SB1}). This is achieved by including gated inputs on the $\overline{WE}$, $\overline{OE}$ and address lines. The gated inputs also facilitate the design of battery backed systems where the designer needs to protect against inadvertent battery current drain during power-down, when inputs may be at undefined levels.

FUNCTIONAL BLOCK DIAGRAM



U1-U4 = MT5C1008DJ

PRESENCE DETECT
PD0 = No Connect
PD1 = No Connect

TRUTH TABLE

MODE	$\overline{OE}$	$\overline{CE}$	$\overline{WE}$	DQ	POWER
STANDBY	X	H	X	HIGH-Z	STANDBY
READ	L	L	H	Q	ACTIVE
NOT SELECTED	H	L	H	HIGH-Z	ACTIVE
WRITE	X	L	L	D	ACTIVE

ABSOLUTE MAXIMUM RATINGS*

Voltage on V_{CC} Supply Relative to V_{SS} ..... -1V to +7V
Storage Temperature ..... -55°C to +125°C
Power Dissipation 4W
Short Circuit Output Current 50mA
Voltage on Any Pin Relative to V_{SS} ..... -1V to V_{CC} +1V

*Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

ELECTRICAL CHARACTERISTICS AND RECOMMENDED DC OPERATING CONDITIONS

(0°C ≤ T_A ≤ 70°C; Vcc = 5V ±10%)

DESCRIPTION	CONDITIONS	SYMBOL	MIN	MAX	UNITS	NOTES
Input High (Logic 1) Voltage		V_{IH}	2.2	V_{CC}+1	V	1
Input Low (Logic 0) Voltage		V_{IL}	-0.5	0.8	V	1, 2
Input Leakage Current	0V ≤ V_{IN} ≤ V_{CC}	I_{LI}	-20	20	µA	
Output Leakage Current	Output(s) disabled 0V ≤ V_{OUT} ≤ V_{CC}	I_{LO}	-5	5	µA	
Output High Voltage	I_{OH} = -4.0mA	V_{OH}	2.4		V	1
Output Low Voltage	I_{OL} = 8.0mA	V_{OL}		0.4	V	1
Supply Voltage		V_{CC}	4.5	5.5	V	1

				MAX					
DESCRIPTION	CONDITIONS	SYMBOL	TYP	-15*	-20	-25	-35	UNITS	NOTES
Power Supply Current: Operating	$\overline{CE}$ ≤ V_{IL}; V_{CC} = MAX f = MAX = 1/ ^tRC outputs open	I_{CC}	380	760	620	560	500	mA	3, 13
Power Supply Current: Standby	$\overline{CE}$ ≥ V_{IH}; V_{CC} = MAX f = MAX = 1/ ^tRC outputs open	I_{SB1}	68	180	160	140	120	mA	13
	LP version only	I_{SB1}	5.2	12	12	12	12	mA	13
	$\overline{CE}$ ≥ V_{CC} -0.2V; V_{CC} = MAX V_{IL} ≤ Vss +0.2V V_{IH} ≥ V_{CC} -0.2V; f = 0	I_{SB2}	1.6	20	20	20	20	mA	13
	L and LP versions only	I_{SB2}	1.2	6	6	6	6	mA	13

*Consult factory

CAPACITANCE

DESCRIPTION	CONDITIONS	SYMBOL	MAX	UNITS	NOTES
Input Capacitance: A0-A16, $\overline{WE}$, $\overline{OE}$	T_A = 25°C; f = 1 MHz Vcc = 5V	C_I	35	pF	4
Input Capacitance: $\overline{CE}$1- $\overline{CE}$4		C12	10	pF	4
Input/Output Capacitance: DQ1-DQ32		$C_{I/O}$	10	pF	4

ELECTRICAL CHARACTERISTICS AND RECOMMENDED AC OPERATING CONDITIONS

(Note 5) ($0°C \le T_A \le 70°C$; Vcc = 5V ±10%)

		-15*		-20		-25		-35			
DESCRIPTION	**SYM**	**MIN**	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**	**UNITS**	**NOTES**
READ Cycle											
READ cycle time	^tRC	15		20		25		35		ns	
Address access time	^tAA		15		20		25		35	ns	
Chip Enable access time	^tACE		15		20		25		35	ns	
Output hold from address change	^tOH	3		3		5		5		ns	
Chip Enable to output in Low-Z	^tLZCE	5		5		5		5		ns	7
Chip disable to output in High-Z	^tHZCE		6		8		10		15	ns	6, 7
Chip Enable to power-up time	^tPU	0		0		0		0		ns	
Chip disable to power-down time	^tPD		15		20		25		35	ns	
Output Enable access time	^tAOE		5		6		8		12	ns	
Output Enable to output in Low-Z	^tLZOE	0		0		0		0		ns	
Output disable to output in High-Z	^tHZOE		5		6		10		12	ns	6
WRITE Cycle											
WRITE cycle time	^tWC	15		20		25		35		ns	
Chip Enable to end of write	^tCW	10		12		15		20		ns	
Address valid to end of write	^tAW	10		12		15		20		ns	
Address setup time	^tAS	0		0		0		0		ns	
Address hold from end of write	^tAH	0		0		0		0		ns	
WRITE pulse width	$^tWP1$	9		12		15		20		ns	
WRITE pulse width	$^tWP2$	12		15		15		20		ns	
Data setup time	^tDS	7		8		10		15		ns	
Data hold time	^tDH	0		0		0		0		ns	
Write disable to output in Low-Z	^tLZWE	3		3		3		3		ns	7
Write Enable to output in High-Z	^tHZWE		6		8		10		15	ns	6, 7

*Consult factory

AC TEST CONDITIONS

Input pulse levels	Vss to 3.0V
Input rise and fall times	3ns
Input timing reference levels	1.5V
Output reference levels	1.5V
Output load	See Figures 1 and 2

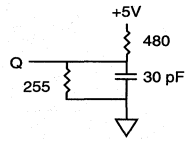


Fig. 1 OUTPUT LOAD EQUIVALENT

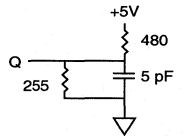


Fig. 2 OUTPUT LOAD EQUIVALENT

NOTES

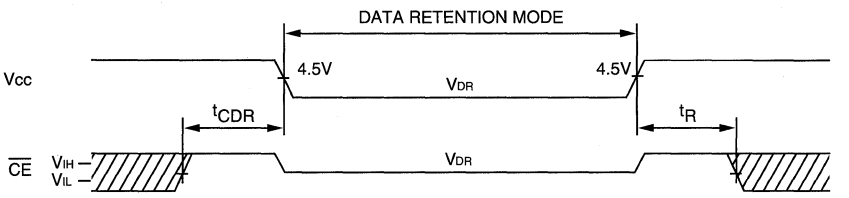
1. All voltages referenced to Vss (GND).
2. -3V for pulse width < ^{t}RC/2.
3. Icc is dependent on output loading and cycle rates.
4. This parameter is sampled.
5. Test conditions as specified with the output loading as shown in Fig. 1, unless otherwise noted.
6. ^{t}HZCE, ^{t}HZOE and ^{t}HZWE are specified with CL = 5pF as in Fig. 2. Transition is measured ±500mV from steady state voltage.
7. At any given temperature and voltage condition, ^{t}HZCE is less than ^{t}LZCE and ^{t}HZWE is less than ^{t}LZWE.
8. $\overline{WE}$ is HIGH for READ cycle.
9. Device is continuously selected. All chip enables are held in their active state.
10. Address valid prior to, or coincident with, latest occurring chip enable.
11. ^{t}RC=Read Cycle Time
12. Chip enable and write enable can initiate and terminate a WRITE cycle.
13. Typical values are measured at 5V, 25°C and 25ns cycle time.
14. Typical currents are measured at 25°C.
15. Output enable ($\overline{OE}$) is inactive (HIGH).
16. Output enable ($\overline{OE}$) is active (LOW).

DATA RETENTION ELECTRICAL CHARACTERISTICS (L version only)

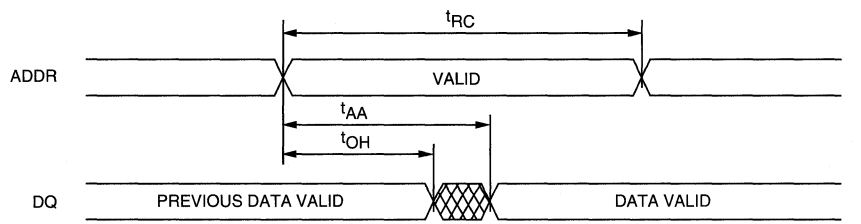
DESCRIPTION	CONDITIONS		SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Vcc for Retention Data			VDR	2			V	
Data Retention Current L Version	$\overline{CE}$ ≥ (Vcc -0.2V) VIN ≥ (Vcc -0.2V) or ≤ 0.2V	Vcc = 2V	ICCDR		140	600	µA	14
		Vcc = 3V	ICCDR		240	1,000	µA	14
		Vcc = 3V*	ICCDR		120	400	µA	14
Data Retention Current LP Version	$\overline{CE}$ ≥ (Vcc -0.2V)	Vcc = 2V	ICCDR		140	600	µA	14
		Vcc = 3V	ICCDR		120	400	µA	14
Chip Deselect to Data Retention Time			^{t}CDR	0			ns	4
Operation Recovery Time			^{t}R	^{t}RC			ns	4,11

*Consult factory

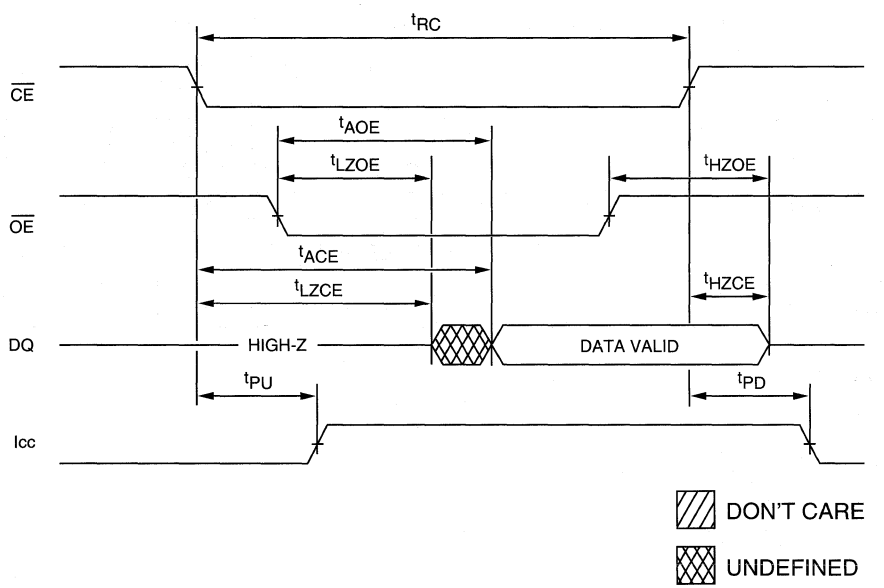
LOW Vcc DATA-RETENTION WAVEFORM



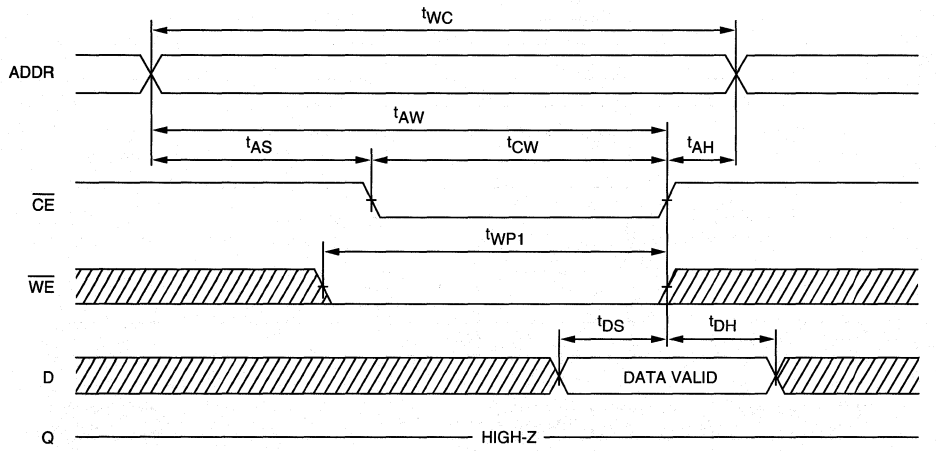
READ CYCLE NO. 1 [8, 9]



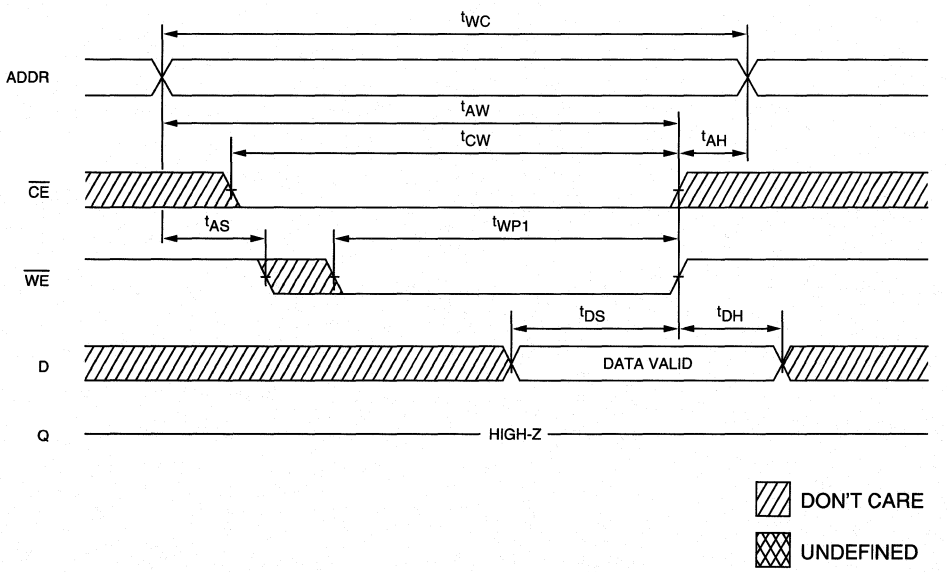
READ CYCLE NO. 2 [7, 8, 10]



WRITE CYCLE NO. 1 [12]
(Chip Enable Controlled)



WRITE CYCLE NO. 2 [12, 13, 15]
(Write Enable Controlled)



WRITE CYCLE NO. 3 [7, 12, 13, 16]
(Write Enable Controlled)